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Does Logistics Performance Foster Sustainable Development? A Moderated Mediation Effect

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Keywords:	Logistics Performance, Sustainable Development Goal 8.5, Tariffs Rate, Trade Openness, Wages of Workers



Does Logistics Performance Foster Sustainable Development? A Moderated Mediation Effect

Abstract

Purpose: This research investigates the moderating role of tariff on the indirect relationship between the logistics performance index (LPI) and workers' overall wages, specifically male and female wages through trade openness (TO). These wage metrics are proxies for assessing progress towards Sustainable Development Goal SDG-8.5.

Design/methodology/approach: Utilising a global dataset encompassing 168 economies from 2007 to 2018, the analysis employs a mediation effect analysis methodology to scrutinise the interconnectedness among LPI, TO, SDG and Tariffs.

Findings: The findings reveal that LPI indirectly influences SDG-8.5 commitments of countries through their degree of TO. Moreover, the moderated mediation analysis elucidates that tariffs play a moderating role in the relationship between LPI and TO. However, the investigation finds no significant link between LPI and the wages of female workers, indicating a sub-component of SDG-8.5.

Research limitations/implications: This study significantly contributes to the existing literature on international development by elucidating the mechanisms and conditional factors through which logistics services can address the gender pay gap as male workers' wages predominantly drive the nexus, thereby advancing the fulfilment of the United Nations 2030 Agenda for Sustainable Development Goals.

Originality/value: This study utilises transaction cost theory and resource-based view theory and combines them with Okun's Law and the Law of the wage curve to test the role of LPI as a source of competitive advantage in enhancing SDG-8.5, while taking into considerations TO and tariffs. This will help in extending both theories and enhance the understanding of their applicability worldwide.

Keywords: Logistics Performance, Sustainable Development Goal 8.5, Tariffs Rate, Trade 5, Openness, Wages of Workers.

Original Article

1. Introduction

The impact of COVID-19 was magnified as it disturbed the global supply chain, which can cause a decline of around 22% of GDP, increase unemployment rate to approximately 24% and eventually lead to a reduction of wages by 17% (Del Rio-Chanona *et al.*, 2020). Therefore, as a leading contributor to the current economic turmoil, studying the consequences of logistics performance is of significance, stemming from its direct and indirect effects on international trade and economic growth worldwide, especially that logistics performance contributed to the global GDP after the pandemic, with a growth rate of 5.9% after a decline of 3.1% (Arvis *et al.*, 2023).

In the wake of the COVID-19 pandemic, which disrupted economies and supply chains globally, the potential for inflation and its implications on economic growth have become a focal point of scholarly interest. This study, anchored in transaction cost theory and resource-based view theory, critically examines the dynamics between logistics performance index (LPI), trade openness (TO) and achieving Sustainable Development Goal (SDG) 8.5, which emphasises equitable wage distribution. The study poses crucial research questions: How does LPI indirectly influence SDG-8.5 through trade openness, and is this relationship affected by international tariff rates? Theoretically, this research is underpinned by Okun's Law and the law of the wage curve, suggesting a correlation between economic output, unemployment rates and wage levels (Tumanoska, 2019). Additionally, the study leverages transaction cost theory and resource-based view theory to rationalise its research model. These theories emphasise the importance of efficient supply chain management and resource sharing in enhancing economic growth and social sustainability (Karatzas *et al.*, 2017, Xi *et al.*, 2014).

1.1 Research gap and contribution

Despite the substantial research on the impact of trade on the wage rate, the nature of the relationship is still ambiguous (Perez-Silva and Krivonos, 2021). In addition, empirical studies provided different findings on the relationship between tariffs and wage rates (Suwanprasert, 2020). Furthermore, emerging research also suggests the need for further investigation on the role of trade on males and females' wage differences (Demiral *et al.*, 2020) and the role of logistics performance on productivity and TO (Barakat *et al.*, 2023a). Moreover, testing these relationships will contribute to the achievement of SGD 8.5 by illustrating the role of LPI, TO and tariffs towards achieving higher wage rates. In other words, this study can provide a guide to countries to overcome trade challenges (Daryanto, 2016) and increase wage rates (Stepanok, 2018) through enhancing overall economic growth (Daryanto, 2016) and welfare (Baldárrago and Salinas, 2017b). In addition, this study aims to address a significant research gap, which involves the unclear nature of the relationship between trade and wage rates, as noted by Perez-Silva and Krivonos (2021) and Xu *et al.* (2021), and the need for further exploration into gender-based wage disparities in international contexts (Demiral *et al.*, 2020). Furthermore, Badur *et al.* (2024) illustrated that trade openness negatively affects sustainable development.

This study uses a moderated mediation approach, previously moderated mediation analysis methods that mainly count on a form of structural equation modelling (SEM). However, these earlier approaches were not derived from a proper causal inference framework, as they did not enable sensitivity analyses regarding crucial identification assumptions (Imai *et al.*, 2011). Therefore, this research in implementing a Medeff estimation to examine the possible moderation

mediating effect of tariffs on the indirect relationship between the LPI and social sustainability (SDG-8.5) through trade openness (TO).

The structure of the study follows a systematic approach. It begins with a theoretical background hypothesis development, followed by data and model framework which contains a detailed research methodology explanation, including statistical techniques and variables. This is succeeded by presenting results and discussion, culminating in a conclusion synthesising the study's key findings and implications.

2. Theoretical background and hypothesis

Drawing on Okun's law and the law of wage curve and the fact that trade openness can lead to economic growth through the diffusion of economic activities (Ogbeide et al., 2015), in addition to the important role that logistics performance plays in facilitating trade (Arvis et al., 2018, Uca *et al.*, 2016), this study focuses on testing the expected mediating role of TO on the association between LPI and SDG 8.5. Besides, this study examines whether the indirect association between logistics performance and SDG 8.5 via trade openness is contingent on the tariffs rate. The formulation of the research model is also rationalised through the theoretical lenses transaction cost theory and resources based view. Transaction cost theory focuses on how supply chain members can decrease their cost through strong alliances and collaborations in order to increase supply chain efficiency (Karatzas et al., 2017). While resources based view also focuses on alliances and collaboration and how it can help organisations acquire a unique bundle of resources to enhance social sustainability (Xi et al., 2014), e.g. employment benefits and stability, (Agrawal et al., 2016) which enhances employees performance (Jerónimo et al., 2020) and eventually lead to enhancement of the organisation competitive advantage (Carter *et al.*, 2017). Based on this, it can be argued that higher logistics performance facilitates trade through promoting global supply chain (Pengman et al., 2022) efficiency (Perakis, 2021, Barakat et al., 2023b), as it decreases transaction cost (Pengman *et al.*, 2022). Figure 1 illustrates the research model.

[INSERT FIGURE 1 HERE]

3. Hypotheses of the study

3.1. The mediating role of trade openness

The existing body of research establishes a global interconnection between logistics and trade openness (Uca *et al.*, 2016, Barakat *et al.*, 2023a, Barakat *et al.*, 2018). Enhanced LPI has been identified as a key driver for growth in trade (Seabra *et al.*, 2016), primarily through the reduction of operational costs and promoting of value adding activities (Barakat *et al.*, 2024) associated with trade activities (Seabra *et al.*, 2016). Additionally, it has been noted for reinforcing trade openness policies (Uca *et al.*, 2016). Investments in LPI encompass improvements in tracking, tracing and appealing to freight forwarders (ITF, 2015), which collectively offers a competitive edge by reducing costs and ultimately enhancing customer service (Shamsuzzoha and Helo, 2011). The bolstering of trade operations via LPI (Havenga et al., 2017) is posited to contribute to economic growth (Patra and Sethi, 2024) by increasing national productivity (GDP) (Okoro et al., 2020, Katrakylidis and Madas, 2019) and increasing country competitiveness (Barakat *et al.*, 2016). Based on the above discussion it can be argued that better logistics performance decreases transaction cost, which leads to high levels of materials and information

exchange (trade openness) as it allows organizations to be an efficient and effective part of the global supply chain. In return, the enhanced productivity increases organisations' demand on labour and leads to economic growth. The importance of international trade comes from the fact that internal resources is not enough for organisations to enhance their competitiveness (Son *et al.*, 2014) and that international trade among global supply chain partners facilitates organisations' access to resources, such as tangible assets (materials) and intangible assets (skills, information and knowledge) that can be used to enhance sustainability (Bag *et al.*, 2019). Thus, it appears that LPI is indirectly linked to wage levels through trade openness. Consequently, the following hypotheses are proposed:

 H_1 : There is a positive influence of logistics performance on trade openness. H_2 : Trade openness acts as a positive mediator in the relationship between LPI and SDG-8.5.

Considering the multifaceted aspects of SDG-8.5, the second hypothesis is further broken down into sub-hypotheses:

 H_{2-a} : Logistics performance positively impacts the total wages of male and female workers (WST) through trade openness.

 H_{2-b} : Logistics performance positively affects the wages of male workers (WSM) through trade openness.

 H_{2-c} : Logistics performance positively impacts the wages of female workers (WSF) through trade openness.

3.2. The moderating role of tariffs

The global trade landscape, particularly during and after the COVID-19 era, has experienced significant disruptions, influencing the flow of goods and services and escalating unemployment rates (Albertoni and Wise, 2021). In response, some nations have implemented trade barriers, such as tariffs, to safeguard domestic industries and stabilise employment (Suwanprasert, 2020, Chae *et al.*, 2019). Tariffs, while protective in nature, can inflate the costs associated with international trade, thus dampening global trade activities (Nugrahapsari *et al.*, 2024). These costs, affecting both shipping and transportation, eventually burden the consumer (Chae *et al.*, 2019). (Borisova and Sorokina, 2024). This reduces the benefits of high logistics performance (Nayak *et al.*, 2024), as the increase in trade cost can eventually negatively affect trade openness (Borisova and Sorokina, 2024).

However, enhancing LPI, as indicated by improvements in countries' LPI, offers a promising solution to these trade challenges (Arvis *et al.*, 2018, Daryanto, 2016). High logistics performance attracts investors as it increases their confidence in the country (Nayak *et al.*, 2024); this confidence promotes trade and capital flow (Salifu *et al.*, 2024), and, in return, it increases demand for labour (Salifu *et al.*, 2024) and, eventually, increases wages rate (Agrawal *et al.*, 2016). Based on the above argument, it can be concluded that enhanced LPI is positively correlated with trade efficiency by reducing trade costs (Host et al., 2019), while trade barriers, such as tariffs, are known to diminish bilateral trade (Chae *et al.*, 2019) as it increases the cost of trade (Tsioumas *et al.*, 2021). Trade liberalisation, by reducing transaction costs, stimulates economic growth (Okoro *et al.*, 2020, Katrakylidis and Madas, 2019), boosts productivity (Baldárrago and Salinas, 2017a), leads to higher wage rates (Paz, 2014) and eventually promotes gender equality (Roy and Xiaoling, 2022). Consequently, this discussion suggests that tariffs may moderate the indirect relationship

between LPI and wage rates through trade openness. We propose the following hypothesis to explore this further:

*H*₃: *Tariff rate moderates the indirect association between lpi and SDG-8.5 via trade openness.*

To comprehensively examine this hypothesis, we divide it into five sub-hypotheses, each focusing on different aspects of wages (SDG-8.5):

 H_{3-a} : Exploring the mediating role of trade openness in the linkage between LPI and the combined wages of male and female workers (WST), moderated by tariff rate (TS).

 H_{3-b} : Assessing if the mediation by trade openness in the relationship between LPI and male workers' wages (WSM) is influenced by tariff rate (TS).

 H_{3-c} : Investigating whether trade openness mediates the connection between LPI and female workers' wages (WSF), with tariff rate (TS) acting as a moderator.

4. Data and model framework

We collected our data from 168 countries around the world that had LPI scores (see appendix), covering the years 2007, 2010, 2012, 2014, 2016 and 2018, as these are the only years that the World Bank published the LPI for. In order to test the developed hypotheses, secondary data were collected from the World Bank data bank (World development indicator – WDI); LPI is used as a proxy for logistics performance. The percentage of exports and imports out of the GDP is used to measure trade openness. Total wages and salaries, in addition to wages and salaries for male and female workers, are used as a proxy for SDG-8.5 or social sustainability. Simple and weighted means for tariffs are used as proxies for tariff rates.

This study uses political stability, control of corruption, exchange rate and the number of population as control variables for the stated associations. Political stability and control of corruption variables are derived from the World Governance Index (WGI). Drawing on earlier literature (e.g., Palonka, 2010, Asongu et al., 2021, Phan et al., 2024), we believe that bilateral trade or international trade relations are affected by the political stability of countries. Specifically, political tension negatively affects capital and resource' flow across countries (Gawarkiewicz and Tang, 2017), which can lead to a decline in economic growth (Asongu *et al.*, 2021). Likewise, control of corruption can affect trade, economic growth (Narayan and Bui, 2021, Okunlola, 2022) and sustainable development (Badur *et al.*, 2024), leading to a decline in tax revenue (Neog and Gaur, 2021), employment (Dang, 2016) and, eventually, economic growth (Neog and Gaur, 2021).

As for the exchange rate, it can directly affect international trade as a decline in the value of the currency can enhance exports and ultimately lead to employment growth and a rise in wage rate levels (Dhasmana, 2021). Regarding population growth, it can negatively affect economic growth (Okoro *et al.*, 2020) as it increases the supply of labour, which, in turn, seems to cause a decline in wages (Nah and Lavoie, 2019).



4.1 Methodology

Following Hicks and Tingley (2011), we apply a moderated mediation¹ effect method to estimate the role of the moderating role of tariffs on the indirect relationship of LPI SDG-8.5 through trade openness. By statistically examining causal mechanisms, we can explain why an indirect association exists between two variables (LPI and SDG-8.5) through a particular channel (TO) (Imai *et al.*, 2011). Crucially, the mediation effect (medeff) estimation implements the processes defined in (Hicks and Tingley, 2011). This process is divided into three separate equations: the first examines the direct impact of the independent variable (LPI) on the mediator (TO), the second equation focuses on the mediating role of TO between LPI and SDG-8.5 and, finally, the third equation illustrates the moderating role of tariff on the impact of LPI on SDG-8.5 through TO.

We specify the main models in this study in the following equations. First, we examine the direct impact of LPI on TO in equation 1 as follows:

 $TO_{i,t} = \beta_0 + \beta_1 LPI_{i,t} + \beta_n Control Variables_{i,t} + \varepsilon_{i,t} (1)$

Second, we explore the potential mediating effect of TO on the association between LPI and SDG-8.5 in equation 2 as follows:

$$SDG8.5_{i,t} = \beta_0 + \beta_1 LPI_{i,t} + \beta_2 TO_{i,t} + \beta_n Control \, Variables_{i,t} + \varepsilon_{i,t} \, (2)$$

Third, we examine the moderated mediating effect of tariffs on the association between LPI and TO in equation 3 as follows:

 $SDG8.5_{i,t} = \beta_0 + \beta_1 LPI_{i,t} + \beta_2 TO_{i,t} + \beta_3 LPI * Tariffs_{i,t} + \beta_n Control Variables_{i,t}$

 $+ \varepsilon_{i.t} (3)$

Where SDG-8.5 is the sustainable development goal number 8 section 5 that is measured by three proxies in the current study: total wages (WST), males' wages (WSM) and females' wages (WSF), LPI is the logistics performance index, TO is trade openness, tariffs variable is tariffs rate that is measured in this study by two proxies: standards tariffs (TS) and weighted tariffs (TW), Control Variables are political stability (PS), control of corruption (CC), the exchange rate (EX) and population (POP).

5. Empirical analysis and Discussion

The study presents descriptive statistics along with their proxies for four principal variables and five controls in Table 1. Our empirical analysis draws upon 1002 observations. The main variables exhibit standard deviations of 0.85, 0.233, 0.411, 0.247, 0.296, 0.306 and 0.348 for LPI, TO, WSF, WSM, WST, TS, and TW, respectively. LPI ranges from 0.08 to 0.63, with an average of 0.447, while TO varies from -0.66 to 2.63, averaging at 0.233. Minimum and maximum values for WSF, WSM and WST are 0.03, 0.86, 0.69 and 2, respectively, with means of 1.617 for WSF,

¹ The moderated mediating effect is conducted based on the following medeff command:

medeff (regress mediator independent interaction term controls) (regress dependent independent mediator controls), mediate (moderator) treat (independent)sims (1000) vce (bootstrap). See Hicks and Tingley (2011) for further details.

1.71 for WSM, and 1.68 for WST. TS and TW exhibit minimums of -1.4 and -2 and maximums of 1.52 and 1.48, with respective means of 0.765 and 0.609.

[INSERT TABLE 1 HERE]

Table 2 presents a correlation matrix to examine relationships among variables and assess multicollinearity. Correlations among various combinations of variables (LPI, TO, CC, PS, EX, POP, WST, WSF, WSM, TS, TW) do not exceed 0.7, satisfying the multicollinearity threshold for mediation effect analysis using OLS estimation (Bansal et al., 2018).

[INSERT TABLE 2 HERE]

Table 3, Panel A, examines the direct relationship between LPI and TO. Panel B tests the mediating effect of TO on the association between LPI and SDG-8.5 proxies (WST, WSF, WSM). Table 4, Panel A, focuses on the moderated mediating effect of tariffs (TS and TW) on the LPI-TO relationship, and Panel B assesses if the indirect effect of LPI on SDG-8.5 through TO depends on tariff rates.

[INSERT TABLE 3 HERE]

[INSERT TABLE 4 HERE]

The findings indicate a significant enhancement of TO by LPI with a β of 6.22 at 1% significance level, supporting Hypothesis 1 (H₁). Trade openness mediates the relationship between LPI and both total and male workers' wages (WST and WSM) with P < 5% and β = 2.3 and P < 1% and β = 2.9 significance levels, respectively, partially supporting Hypothesis 2 (H₂). However, TO's mediation in the LPI-WSF relationship with β = 1.1 is not significant as the P = 0.24. Tariff rates (TS and TW) moderate the LPI-TO relationship and the indirect association between LPI, WST and WSM via TO with a β = 2.5, P = 0.01 and β = 3.1, P = 0.002, respectively. This lends partial support to Hypothesis 3 (H₃), validating H_{3-a} and H_{3-b} while rejecting H_{3-c} as its P = 0.18 with a β = 1.33. Table 5 summarises the key findings. Control variables CC, EX and POP are significant in testing the moderated mediating role of tariff rates on the indirect LPI, SDG-8.5 relationship through TO, while PS is not significant.

[INSERT TABLE 5 HERE]

Previous studies corroborate our findings. Barakat *et al.* (2023a) illustrated that LPI can enhance TO in Europe. While, Barakat *et al.* (2018) concluded that LPI can enhance exports in the Middle East and African countries. Katrakylidis and Madas (2019) show LPI's significant impact on TO. This can be justified as countries with lower LPI score pay more in transporting goods and processing it through bottlenecks in seaports and airports (Seabra *et al.*, 2016).

Gries and Redlin (2020) note TO's varying effects on income levels, particularly its fewer benefits in developing economies due to institutional and human capital limitations. These views align with Onifade *et al.* (2020) and Stepanok (2018), suggesting TO's complex impact on unemployment and wage rates. Onifade et al. (2020) illustrated that trade openness has a clear and positive impact on unemployment; however, this impact differs from developed or developing countries. This means that trade openness improves the economic performance including wage rate of the exporting countries over the importing countries (Galle and Lorentzen, 2024). On the other hand, Albertoni and Wise (2021) illustrated that disruptions in international trade at the world level have proven to lead to weakness and decrease in the flow of goods and services and an increase in unemployment rates.

One of the problems of international trade is that it can lead to a decline of welfare, especially for developing countries, which forces governments to rely on tariffs as a trade policy to limit trade openness (Suwanprasert, 2020). The discussion of tariffs' diverse effects was further elaborated by Stepanok (2018), as the author tied tariffs to unemployment and wage rates. Moreover, Jiang and Han (2021) advocate for stable tariffs to bolster trade activities, supporting the strategic combination of LPI and tariffs for enhanced exports and economic benefits.

The study also reveals a non-significant link between LPI and female wages (WSF) through TO, resonating with Perez-Silva and Krivonos (2021) and Xu *et al.* (2021) findings on TO's ambiguous and sometimes negative impact on gender wage equality. This calls for direct governmental interventions for gender economic inclusion (Asongu and Odhiambo, 2020) and acknowledges the different gender impacts of TO due to varying labour market roles .

6. Conclusion and policy implications

The findings of this study suggest that tariffs moderate the indirect effect of logistics performance on some SDG8.5 measures (i.e., total wages and male wages) via trade openness globally. However, our study indicates no evidence supporting the indirect link between LPI and female wages as a sub-proxy of SDG8.5. This implies that gender pay inequality exists worldwide. In other words, we argue that the indirect influence of LPI on SDG8.5 via TO is driven by an increase in the wages of male workers.

6.1 Theoretical implications

This research uniquely contributes to the literature (referencing works like Perez-Silva and Krivonos (2021), Suwanprasert (2020) and Badur *et al.* (2024) by investigating how LPI influences wage rates, serving as a surrogate for the United Nations' Sustainable Development Goal (SDG) 8.5. This research also contributes to the debate regarding the impact of TO's varying effects on income levels (Gries and Redlin, 2020, Onifade *et al.*, 2020, Perez-Silva and Krivonos, 2021), in addition to the debate on the impact of tariff on wage rate (Suwanprasert, 2020) and the impact of TO on income equality (Demiral et al., 2020). Moreover, it answers the call of Barakat *et al.* (2023a) regarding the need for further investigation on the impact of LPI on TO. This study used a novel approach through combining two theoretical lenses: transaction cost theory and resource-based view and Okun's law and the law of wage curve in order to present LPI as a tool to bridge the gap between unemployment and productivity on the one hand, and between unemployment and wage rate on the other hand.

6.2 Practical implications

Analysing data from 168 countries, we found that TO plays a mediating role in the relationship between LPI and SDG-8.5, a link that depends on tariff rates. However, the impact was not significant when examining female wages (WSF) as a measure of SDG-8.5, highlighting a global gender wage disparity driven predominantly by male wages. This adds depth to our understanding of how these factors contribute to gender pay inequality globally (Perez-Silva and Krivonos, 2021), given the lack of a substantial link between TO and WSF. The findings suggest that strategic tariff implementation can leverage LPI to boost productivity, employment and wages,

as higher LPI can attract investments (Tabak and Yildiz, 2018) and enhance countries' competitiveness (Arvis *et al.*, 2018). Governments can also focus on enforcing laws and regulations to promote gender equality (Asongu and Odhiambo, 2020), along with using LPI and tariffs to enhance wage rates through TO in order to achieve higher wage rates for both males and females. This is expected to help countries achieve SGD 8.5 worldwide, as TO will create decent work opportunities for all women and men and equal pay for work.

6.3 Limitations and recommendations for future research

Despite its comprehensive nature, this study has limitations. It utilises the overall LPI score, omitting the analysis of its six individual components, which future research could explore in relation to male and female wage rates via TO. The study's focus is limited to TO as a mediator and tariffs as a moderator; subsequent research might examine other mediators like foreign direct investments and moderators such as cultural and governance factors. Further inquiries should also assess LPI's impact on exports, employment and wages in specific industries. Moreover, logistics activities raise environmental issues (Ali et al., 2023); however, because of its importance, it is important to embed environmental activities into LPI components to gain its benefits without harming the surrounding environment. Future research should take into consideration how monetary and fiscal policy as well as the efficiency of the banking sector can play a role in the dynamic relationship between LPI, tariff, TO and wage rate. In addition, other methodologies should be adapted by future research, such as specific case studies and interviews to conduct a road map with key performance indicators of how countries can utilise logistics activities and trade policies to enhance trade and eventually promote welfare and income growth and equality. Finally, it is crucial to explore how LPI and its components can advance other SDGs, such as SDG-2, which aims to end hunger, considering LPI's potential to optimise the delivery of food and essential items efficiently and cost-effectively.

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Figure 1: The conceptual framework of the study

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Appendix: Sampled Countri	es		
Afghanistan	Djibouti	Lao PDR	Romania
Albania	Dominican Republic	Latvia	Russian Federation
Algeria	Ecuador	Lebanon	Rwanda
C			São Tomé and
Angola	Egypt, Arab Rep.	Lesotho	Principe
Argentina	El Salvador	Liberia	Saudi Arabia
Armenia	Equatorial Guinea	Libya	Senegal
Australia	Eritrea	Lithuania	Serbia
Austria	Estonia	Luxembourg	Sierra Leone
Azerbaijan	Ethiopia	Macedonia, FYR	Singapore
Bahamas, The	Fiji	Madagascar	Slovak Republic
Bahrain	Finland	Malawi	Slovenia
Bangladesh	France	Malaysia	Solomon Islands
Belarus	Gabon	Maldives	Somalia
Belgium	Gambia, The	Mali	South Africa
Benin	Georgia	Malta	Spain
Bhutan	Germany	Mauritania	Sri Lanka
Bolivia	Ghana	Mauritius	Sudan
Bosnia and Herzegovina	Greece	Mexico	Sweden
Botswana	Guatemala	Moldova	Switzerland
Brazil	Guinea	Mongolia	Syrian Arab Republic
Brunei Darussalam	Guinea-Bissau	Montenegro	Taiwan, China
Bulgaria	Guyana	Morocco	Tajikistan
Burkina Faso	Haiti	Mozambique	Tanzania
Burundi	Honduras	Myanmar	Thailand
Cambodia	Hong Kong SAR, China	Namibia	Timor-Leste
Cameroon	Hungary	Nepal	Togo
Canada	Iceland	Netherlands	Trinidad and Tobago
Central African Republic	India	New Zealand	Tunisia
Chad	Indonesia	Nicaragua	Turkey
Chile	Iran, Islamic Rep.	Niger	Turkmenistan
China	Iraq	Nigeria	Uganda
Colombia	Ireland	Norway	Ukraine
Comoros	Israel	Oman	United Arab Emirates
Congo, Dem. Rep.	Italy	Pakistan	United Kingdom
Congo, Rep.	Jamaica	Panama	United States
Costa Rica	Japan	Papua New Guinea	Uruguay
Cote d'Ivoire	Jordan	Paraguay	Uzbekistan
Croatia	Kazakhstan	Peru	Venezuela, RB
Cuba	Kenya	Philippines	Vietnam
Cyprus	Korea, Rep.	Poland	Yemen, Rep.
Czech Republic	Kuwait	Portugal	Zambia
Denmark	Kyrgyz Republic	Qatar	Zimbabwe



Variable LPI Logistics performance index					
LPI Logistics performance index	Obs	Mean	Std. Dev.	Min	Max
	1008	.447	.085	.08	.63
Trade Openness (% of GDP) (TO)	1008	1.892	.233	66	2.63
WSF Wage and salaried workers, female	1008	1.617	.411	.03	2
(% of female employment) (WSF)					
WSM Wage and salaried workers, male (%	1008	1.71	.247	.86	2
of male employment) (WSM)					
WST Wage and salaried workers, total (%	1008	1.68	.296	.69	2
of total employment) (WST)					
TS Tariff rate, applied, simple mean, all	1002	.765	.306	-1.4	1.52
products (%) (TS)					
TW Tariff rate, applied, weighted mean.	1002	.609	.348	-2	1.48
all products (%) (TW)	-				-
CC Control of Corruption (CC)	1008	.855	.568	0	2.45
PS Political Stability and Absence of	1008	.777	604	Õ	3.22
Violence/Terrorism (PS)	1000	• • • •		v	
EX Official exchange rate (EX)	1008	1 738	1 225	- 67	4 61
POP Population total (POP)	1008	7 01	721	4 85	9 1 4

Table 2: Matrix of correlations

LPI 1	(-)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
TO 0.182	* 1									
WSF 0.550	* 0.234*	1	1							
WSM 0.560	* 0.280*	0.947*	1	1						
0.502 TS 0.502	* _0.200*	0.980*	-0 496*	0 511*	1					
TW 0.488	* -0.323*	0.483	-0.475*	0.489*	0.914	1				
CC 0.24	4 0.033	0.004*	0.020*	0.021*	-0.211*	-0.197*	1			
PS 0.05	5 0.070 *	-0.174	0.176*	0.156*	0.012*	-0.011*	0.438	1		
) EX 0.152	* 0.057*	0.338*	0.358*	0.356*	0.181	0.193	0.140*	0.119*	1	_
) POP 0.163	* -0.456	0.136*	0.141	0.139*	0.136	0.097*	0.007*	0.187	0.144*	1

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	ТО	
Independent:	6.220***	
LPI	(0.000)	
Controls:	-1.240	
CC	(0.214)	
PS	2.480**	
	(0.013)	
EX	1.300	
	(0.192)	
POP	12.740***	
	(0.000)	
No. obs	1,008	
Adj R-squared	0.49	

re in pa. Note: Bootstrapped standard errors are in parenthesis. *** p < 0.01, ** *p*<0.05, **p*<0.1

Table 3 – Panel B

The indirect effect of LPI on SDG-8.5 via trade openness (mediation effect analysis)

	WST	WSF	WSM
ndependent:	19.220***	18.560***	17.100***
PI O	(0.000)	(0.000)	(0.000)
Aediator:	2.320**	1.170	2.900***
O	(0.020)	(0.242)	(0.004)
Controls:	-3.070***	-4.120***	-2.270**
CC	(0.002)	(0.000)	(0.023)
'S	0.930	1.190	1.840*
	(0.352)	(0.233)	(0.066)
EX	8.470***	7.690***	8.860***
	(0.000)	(0.000)	(0.000)
OP	5.000***	5.780***	4.240***
	(0.000)	(0.000)	(0.000)
cons	9.180***	6.820***	10.840***
	(0.000)	(0.000)	(0.000)
lo. obs	1,008	1,008	1,008
Vald chi2(6)	713.04	699.36	653.81
rob > chi2	0.000	0.000	0.000
dj R-squared	0.4393	0.4177	0.4418
<u>CME</u>	0.087	0.060	0.092
Direct Effect	1.943	2.725	1.569
otal Effect	2.029	2.785	1.661
6 of Tot Eff	0.043	0.022	0.055
nediated			

	Without	IO Without	TO	10 With Interaction
	Interaction	Interaction	Interaction	
Independent:				
LPI	4.350**	3.110 **	5.480***	5.100***
	(0.060)	(0.052)	(0.000)	(0.000)
Moderators:				
LPI*TS	_	_	5.540***	-
	-	-	(0.000)	
LPI*TW	<u> </u>	-	-	5.780***
TO	0.000**		2 5 00***	(0.000)
18	2.230**	-	2.580***	-
TW	(0.020)	1 150***	(0.010)	5 370***
1 W	-	(0,000)	-	(0,000)
Controls		(0.000)		(0.000)
CC	1 730*	2.250***	2.720***	2 710***
~~	(0.083)	(0.025)	(0.007)	(0.007)
PS	2.580***	1.870**	1.800*	1.930*
	(0.010)	(0.061)	(0.072)	(0.054)
EX	5.760***	2.730***	2.510**	2.720***
	(0.000)	(0.006)	(0.012)	(0.006)
POP	9.830***	10.860***	10.140***	11.170***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of obs	1,002	1,002	1,002	1,002
11		i parenthesis. *** p<	0.01, ** p<0.05, *	p<0.1
		i parentnesis. *** p<	0.01, ** p<0.05, *	p<0.1

Table 4 – Panel A

The moderating effect of tariff rate on the relationship between LPI and trade openness

	WST	WSF	WSM
Independent:			
LPI	22.720***	22.160***	20.920***
	(0.000)	(0.000)	(0.000)
Mediator:			
ТО	2.520**	1.330	3.130***
	(0.012)	(0.184)	(0.002)
Controls:			
СС	-3.170***	-4.190***	-2.440**
	(0.002)	(0.000)	(0.014)
PS	0.800	0.990	1.570
	(0.423)	(0.320)	(0.117)
EX	9.260***	8.850***	9.540***
	(0.000)	(0.000)	(0.000)
POP	5.760***	7.280***	4.570***
	(0.000)	(0.000)	(0.000)
_cons	9.750***	7.260***	11.430***
	(0.000)	(0.000)	(0.000)
Number of obs	1,002	1,002	1,002
Wald chi2(6)	1071.44	1084.09	932.03
Prob > chi2	0.0000	0.0000	0.0000
Adj R-squared	0.4373	0.4155	0.4402
ACME	0.079	0.051	0.078
Direct Effect	1.946	2.729	1.572
Total Effect	2.025	2.780	1.650
% of Tot Eff mediated	0.039	0.018	0.047

Note: Bootstrapped standard errors are in parenthesis. *** p < 0.01, ** p < 0.05, * p < 0.1

	0				
Hypothesis	Independent	Mediation	Moderation	Dependent	Supported/Not supported
H_1	LPI			ТО	Supported
H_2	LPI	ТО		SDGs	Partially Supported
H_{2-a}	LPI	ТО		WST	Supported
H_{2-b}	LPI	ТО		WSM	Supported
H_{2-C}	LPI	ТО		WSF	Not Supported
11	LPI	ТО	TS	SDGs	Partially Supported
113			TW	SDGs	Partially Supported
Ц	I DI		TS	WST	Supported
113-а	LFI	10	TW	WST	Supported
II	IDI	то	TS	WSM	Supported
П3-В	LFI	10	TW	WSM	Supported
II	IDI	ТО	TS	WSF	Not Supported
Пз-С		10	TW	WSF	Not Supported

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5	9
6	0

International Journal of Social Economics

Manuscript ID: IJSE-05-2024-0392

Manuscript Title: " Does Logistics Performance Foster Sustainable Development? A Moderated Mediation Effect",

Dear Editor and Reviewer,

Please find attached our revised manuscript (entitled " Does Logistics Performance Foster Sustainable Development? A Moderated Mediation Effect") re-submitted for possible publication in the International Journal of Social Economics.

We have made revisions and stylistic improvements to the paper according to your suggestions. The changes have been highlighted in the manuscript. Below is our detailed response to your comments. We believe that the paper is now stronger as a result of your review and helpful suggestions.

Yours sincerely,

The Authors

. 2010 0 10 **Response to feedback from the Reviewer**

Reviewer: 1	Authors' response
Authors need to go through the already	Thank you. The design of the manuscript
published manuscripts of this journal in order to	was updated to match previous studies in
get the idea of designing the paper accordingly, i	the journal.
hope these comments will motivate you to make	Specifically, the following paper was
efforts to make this manuscript more robust for	used as it is the most appropriate to the
publication Thank you	current manuscript
	Patra, B. and Sethi, N. (2024), "Financial
	development and growth nexus in Asian
	countries: mediating role of FDI, foreign
	aid and trade". International Journal of
	Social Economics, Vol.51. No.5. pp.623-
	640. https://doi.org/10.1108/IJSE-09-
	2022-0587
To some extent originality is there but it needs	Based on the previous comment, a new
improvement in all the sections.	subtitle was added under the introduction
	"1.1 Research gap and contribution"
	explaining in details the novelty of the
	study, in addition to the development of
	the framework and how Okun's law and

Background on which Hypothesis Development has been set in this manuscript is not adequate as it should be, need more concentration. <u>Methodology: Good</u> Results are not presented in a way to sync with discussion section, needs more focus.	the law of wage curve and the theoretical lenses transaction cost theory and resource-based view were combined to develop this framework. Furthermore, it explains how the current research extends these theories and connects previous studies. The title "2. Theoretical background and hypothesis" is now illustrated as an extension of the sub section 1.1. New and updated literature was added and combined with the logic of Okun's law and the law of wage curve and the theoretical lenses transaction cost theory and resource-based view to strengthen the argument leading to the hypotheses. Thank you for your comment. Specific statistics were added, and a table that shows the summary of the results (Table 5) of the hypothesis testing was created. Then, the discission was expanded through discussing the results
Implications for research, practice and/or society: Not incorporated in the manuscript, the authors need to go through the manuscripts of this journal in order to get clarity on designing the manuscript properly.	in light of previous studies output using recent and updated literature. The section "6. Conclusion and policy implications" is now illustrating the summary of the results. In addition, it was divided into three subsections. First the summary of the results is illustrated. Then, "Theoretical implications" sub section illustrates how the results fill the literature gap. Followed by "Practical implications" sub section which presents the practical contribution of the study. Finally, limitations of the study and recommendations for future research are presented. Thank you for your comment. The entire manuscript has been proofread and
	manuscript has been proofread and checked for any typos and grammatical errors.
Reviewer: 2	
Introduction and Context: The introduction could be expanded to provide more context about the significance of logistics performance in the context of sustainable development, particularly in the wake of the COVID-19 pandemic. This could include more specific examples and statistics to illustrate the impact of logistics disruptions on economic	Thank you for your comment. The introduction now contains statistics, explaining the impact of logistics disruptions on the global GDP and wage rate. In addition, it was expanded to illustrate the role of LPI and TO on wage rate, in addition to presenting Okun's law and the law of wage curve and the

growth and sustainable development goals. The introduction should clearly state the research questions and objectives, which are currently buried in the literature review section.	theoretical lenses transaction cost theory. Furthermore, it illustrates the importance of the study, its aim and the research questions. Finally, a subtitle was added to explain in details the novelty of the study. In addition, to the development of the framework and how Okun's law and the law of wage curve and the theoretical lenses transaction cost theory and resource-based view were combined to develop this framework. Furthermore, it explains how the current research extends these theories and connects previous studies.
Literature Review: The literature review could be more concise and focused. It should provide a clear summary of the key studies and theories used in the paper, rather than including extensive quotes from these studies. The review should include more recent studies and a broader range of sources to provide a more	New and updated literature was added and combined with the logic of Okun's law and the law of wage curve and the theoretical lenses transaction cost theory and resource-based view to strengthen the argument leading to the hypotheses.
comprehensive overview of the field. Methodology: The methodology section should provide more details about the data collection process, including the specific sources of the data and any potential biases or limitations. The statistical techniques used should be explained in more detail, including the specific models and tests employed.	Details regarding the data, the statistical models and the steps used were illustrated. This included the sources of the data the equation and the command used in STATA
Results and Discussion: The results section could be more detailed and include more specific statistics and figures to illustrate the findings. The discussion should provide a more thorough analysis of the implications of the findings, including potential policy and practical applications.	The discussion was expanded through discussing the results in light of previous studies' output using recent and updated literature. In addition, specific statistics were added and a table (Table 5) that shows the summary of the results of the hypothesis testing. An introduction of the research implications was presented and then expanded in the conclusion section.
Conclusion: The conclusion should summarize the key findings and their implications more clearly and concisely. The conclusion should also provide a clear statement about the contributions of the study to the existing literature and its potential future directions.	The section "6. Conclusion and policy implications" now illustrates the summary of the results. In addition, it was divided into three subsections. First the summary of the results is illustrated. Then, "Theoretical implications" sub section illustrates how the results fill the literature gap. Followed by "Practical implications" sub section which presents

Poforonoos:	the practical contribution of the study. Finally, limitations of the study and recommendations for future research are presented.
The references: The references should be formatted consistently and include all the sources cited in the paper. The references should be updated to include more recent studies and a broader range of sources.	references were reviewed and updated to illustrate a broader range of sources.